*Measuring and Reporting the Wind*

# Anemometers and Windsocks

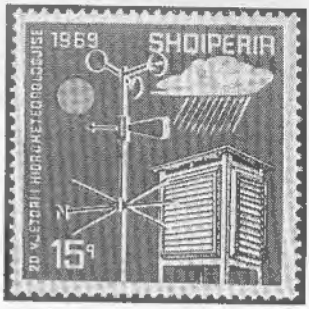
*Donald Hillger and Garry Toth*

As follow-up to our previous articles on the thermometer and the barometer, this article features anemometers and windsocks. A large number of stamps show devices for measuring the speed and direction of the wind. Besides anemometers, there are a number of stamps that show windsocks, a less-quantitative but still very important means of measuring the wind at smaller airports. However, this article excludes wind vanes and weathercocks, both of which are more decorative than meteorological in purpose.

The word anemometer comes from the Greek word for wind (*anemos*). The anemometer is an instrument that measures the wind speed alone, or the wind speed and direction. Measurements of the wind at surface weather stations are based on standards designed to ensure that the wind speed and direction are representative of the weather conditions in the surrounding area. The World Meteorological Organization (WMO) standard height for anemometer and wind vane exposure is 10 meters above ground level with no obstructions within 300 meters of the site. As a general rule of thumb, the distance between an obstruction to the wind and the anemometer should be at least 20 times the height of the obstruction. A second wind-speed measurement may be taken at the height of the temperature and moisture sensors (1.5 meters) when evapotranspiration (evaporation and transpiration) estimates are desired.

Another standard for wind measurement is the averaging time. Wind is highly variable with short-period gusts lasting a few seconds, and longer variations lasting several minutes. For weather forecasting purposes, wind speeds refer to the ten-minute average wind. This integrates the wind variations into a meaningful value that can be more easily used on synoptic weather maps. Often the ten-minute average wind is accompanied by the peak gust during that time interval, as an indication of both the maximum wind and the variability of the wind. A typical wind measurement may be ten knots with wind gusts to twenty knots.


**Three-cup Anemometer With Wind Vane**
**Canada (*Scott* 479)**




**Three-Cup Anemometer Clearly Shown**
**Albania (*Scott* 1208)**

## Cup-and-Vane Anemometer

There are a large variety of types of anemometers shown on stamps. The most common type of meteorological anemometer is the cup-and-vane anemometer, invented in the 1800s by John Robinson. This anemometer measures the wind speed by the rotation of a windmill that consists of three or four hemispherical or conical cups fixed to the ends of horizontal arms attached to a vertical axis. The cups are used to measure the wind speed, and the vane is used to determine the wind direction. It is easy to count the number of cups on stamps that show larger or more detailed representations of anemometers. Cup anemometers on stamps can be divided into two major groups, those with three and those with four cups. A three-cup anemometer exerts a more uniform torque throughout a revolution, and therefore gives a more representative wind speed measurement.

Three-cup anemometers with wind vanes are shown particularly well on the following stamps: Albania (1969/*Scott* 1208); Algeria (1966/*Scott* 351); Belgium (1958/*Scott* C16); Canada (1968/*Scott* 479); China/Taiwan (1981/*Scott* 2250-2251); Egypt (1962/*Scott* C96, 1965/*Scott* C106, 1973/*Scott* C157, and 1997/*Scott* C220); India (1975/*Scott* 708); Iran (1964/*Scott* 1285, 1989/*Scott* 2362-2363, and 1991/*Scott* 2454); Myanmar (2000/*Scott* 350); Nigeria (1973/*Scott* 311-312); Qatar (1973/ *Scott* 350); El Salvador (1989/*Scott* 1195-1196); Saudi Arabia (1967/*Scott* 456-


**Four-cup Anemometers Are Less Common**
**Upper Volta (*Scott* 93)**


**Four-cup Anemometer Without Wind Vane**
**Niger (*Scott* C105)**

460, and 1975/*Scott* 670); Senegal (2000/*Scott* 1442); Slovenia (2000/*Scott* 425 and 425a); Sri Lanka (1998/Scott 1234); Switzerland (1956-1960/*Scott* 803-809); Syria (1965/*Scott* 470-471); and U.S. (1970/*Scott* UX57). The final item, a U.S. postal card, issued for the centenary of the U.S. Army Signal Service, a predecessor to the U.S. Weather Service, shows two three-cup anemometers.

Four-cup anemometers with wind vanes are much less common than three-cup anemometers. They are shown particularly well on the following items: Iraq (1908/*Scott* 959-961); Niger (1964/*Scott* C41); and Upper Volta (1961/*Scott* 93). Of these items, the top-down view of the anemometer on the set of three Iraqi stamps is a symbolic view of an anemometer compared to the more realistic views of anemometers on the other stamps.

A four-cup anemometer is also shown on a miniature sheet issued by German Democratic Republic (1972/*Scott* 1362). This stamp also contains another type of anemometer. The ten-cup device below the four-cup anemometer and the wind vane is a bridled anemometer, a wind measuring device that does not rotate freely but is bridled or halted by springs that only allow it to rotate a small amount in proportion to the force of the wind. This force is then translated into wind speed. Both these devices could be used simultaneously to allow comparison of the wind speed measurements from the two instruments. Bridled anemometers are not known to appear on any other postal items, nor are they common in modern meteorology.

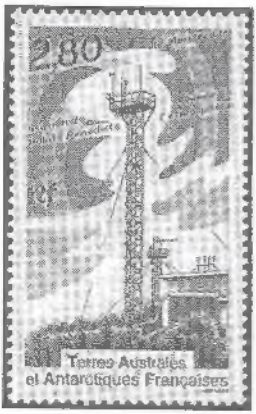
Three and four-cup anemometers are also seen without wind vanes. In these cases the anemometer is able to only measure the wind-speed and not the wind direction. There are uses for wind-speed only measurements, without regard to the wind direction, such as to estimate the rate of evaporation of surface moisture. However, it is not clear whether the representations of most of the only wind-speed anemometers shown on stamps were intentional or a matter of neglecting to show the accompanying wind vane.

Three-cup anemometers without wind vanes are shown on the following items: Finland (1994/*Scott* 938); Kenya-Uganda-Tanzania (1973/*Scott* 259); and Turkish Republic of Northern Cyprus (1992/*Scott* 337). Four-cup anemometers without wind vanes are shown on Niger (1969/*Scott* C105), and Tunisia (1978/*Scott* 736).

There are many other postal items showing anemometers where the number of cups is indeterminate. In some cases the angle of view does not allow all the cups to be seen, as in the case of a side view where the cups in the back are either not seen or not drawn by the artist. In other situations the images of the anemometers are too small to confidently count the number of cups. Such cup-type anemometers with wind vanes are found on the following items: Bangladesh (2000/*Scott* 606); Cuba (1971/*Scott* 1591); Ethiopia (1973/*Scott* 662); Indonesia 2000/*Scott* 1897); Mauritania (1964/*Scott* 175); Nigeria (2000/*Scott* 708); Philippines (1965/Scott 922-924, 1970/*Scott* 1069); Russia (1971/*Scott* 3860); Uganda (1993/*Scott* 1194, 1198, 2001/*Scott* 1701); and Vanuatu (1992/*Scott* 565). Of those anemometers with indeterminate number of cups, one without a wind vane is shown on Morocco (1964/*Scott* C10).

Some of the smaller anemometers are those seen on tops of buildings. Measuring the wind from the top of a building certainly allows the instrument to be higher above the ground, but the building can interfere with the


**Smaller Anemometers Are On Buildings**
**Costa Rica (*Scott* 409)**




**Several Anemometers On One Tower**
**French Southern and Antarctic Territories (*Scott* 215)**

wind flow, making the measurements less representative of the true wind than if the wind speed and direction were taken by an anemometer on a tower. Anemometers on buildings are found on the following items: China/Taiwan (1962/*Scott* 1338); Costa Rica (1988/*Scott* 409, 1991/*Scott* 439); Czechoslovakia (1957/*Scott* 837); Japan (1949/*Scott* 459); Panama (1964/*Scott* 457D); and Turkey (1961/*Scott* B81). The Japanese stamp claims to show two anemometers: an anemoscope, a vane-like device for measuring wind-direction only; and a pressure-tube anemometer, a device that typically contains a small hole that is kept pointed into the wind. The wind speed is determined by the increased pressure into that hole caused by the wind. The pressure tube anemometer is generally attributed to W. H. Dines, who in the late 1900s constructed a device of sufficient accuracy to be used extensively in meteorology.

There are also anemometers mounted on towers, or towers where the anemometers can be seen but are too small to give much detail. Such anemometers are seen on the following items: Afghanistan (1963/*Scott* 647, 650, C47, C49); Belize (1991/*Scott* 972); Bulgaria (1936/*Scott* 301); China (1960/*Scott* 484, 1978/*Scott* 1384); French Southern and Antarctic Territories (1957/*Scott* 8-10, 1976/*Scott* C45, 1986/*Scott* C92 (1986), and 1996/*Scott* 215); Namibia (1991/*Scott* 693); New Zealand (1984/*Scott* 794, 794a); Russia (1961/*Scott* 2495); and Viet Nam (1992/*Scott* 2338 (1992). The 1986 French Southern stamp is interesting in that it clearly shows several anemometers on the tower. This type of instrumented tower is often used to study the atmospheric boundary layer, using a succession of measurements at different levels above the ground.


**Anemometer On Weather Ship Mast**
**Qatar (*Scott* 347)**

## Propeller Anemometers

Hand-held anemometers are found on Australian Antarctic Territory (1966/*Scott* L13) and Indonesia (1975/*Scott* 840). Both are three-cup anemometers; since they are hand-held and not directionally oriented, they are able to measure the wind speed only, not the wind direction. The first stamp also contains a type of instrument found on no other stamp: the three rocket-like devices in the background. This type of wind gauge (which may be a type of pressure-tube anemometer) is probably meant for measuring and enduring very high winds, as are frequently encountered in Antarctic regions. However evidence of these devices actually being used has not been found.

Propeller anemometers are found on Afghanistan (1989/*Scott* 1360) and Micronesia (1998/*Scott* 297). The latter item is the only stamp with an anemometer on an ocean buoy. Several other stamps show ocean buoys, but on all of them the twin anemometer-like devices are wind generators used to power the instruments on the buoy. These are found on the following items: Central Africa Republic (1973/*Scott* C115); Grenada (1973/*Scott* 491); Maldives (1974/*Scott* 466, 470); and Niger (1967/*Scott* C71). Each of these items shows a NOMAD (Navy Oceanographic Meteorological Automatic Device) buoy. This type of buoy was developed in the 1940s and has a six meter long hull that looks somewhat like a boat. The NOMAD design has been adopted by Canada's Atmospheric Environment Service for deep ocean stations of the east and west coasts. Ocean buoys typically have both meteorological and oceanographic sensors as well as telemetry to relay measurements to receiving stations, sometime through satellite links.

Anemometers are also common on ships, but are often not depicted at high enough resolution so that they can be definitely identified on stamps. Anemometers on the masts of weather ships can be identified on Dubai (1970/*Scott* 121) and Qatar (1973/*Scott* 347).


**Tilting-Plate Anemometer Invented in 1450**
**Finland (*Scott* 767)**


**Wind Speed In Units Is Recorded**
**Portugal (*Scott* 1113)**

All of the anemometers already mentioned are either cup and vane anemometers or propeller anemometers. Another type of anemometer that is much less common is the pressure-plate or tilting-plate anemometer, where the wind pushes on a flat plate that is lifted as the wind blows on the plate. The wind speed is then measured on a scale in the form of an arc that measures the deflection of the plate by the wind. The tilting-plate anemometer was the first man-made instrument for measuring wind speed and is attributed to the Italian mathematician Leon Battista Alberti, who described the device in a treatise published around 1450. Such anemometers are seen on Finland (1988/*Scott* 767) and Russia (1956/*Scott* C97).

Much less common on stamps are the devices for recording the wind speed and direction measured by anemometers. Jersey (1082/*Scott* 294) shows an anemotachymeter, the name of which implies that it records wind-speed only, and not wind direction. Maldives (1974/*Scott* 468) shows a Richard's electrical wind-speed (only) recorder. This device, dating from around 1900, was named after Jules Richard, whose firm produced weather and oceanographic instruments. Richard was also a director of the Monaco Oceanographic Museum.

Although the recording instrument is not seen, a wind trace is found on Portugal (1971/*Scott* 1113). There appears to be traces for both the wind speed and direction. With a magnifying glass the wind speed units of km/h are seen on the lined graph paper background. Also on the Portugal stamp is a three-cup anemometer.

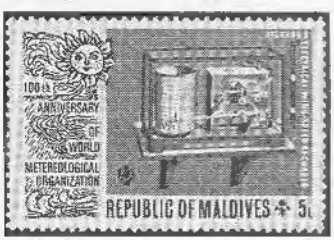
## The Wind Rose

The next wind-related item of special note is seen on Hong Kong (1983/*Scott* 420). That is a wind rose, a circular graphical pattern of the wind speed and direction. The lengths of the "spokes" in the wind rose diagram are related to the frequency that the wind blows from that direction. A wind rose is useful for characterizing the wind pattern at an anemometer site. The example shown indicates that the wind blows much more frequently from the east and southeast than from any of the other directions. Also on the Hong Kong stamp is a three-cup anemometer. The words "wind rose" are also found in the Spanish text on Argentina (1985/*Scott* B105a), but the drawing looks more like a compass rose, with compass directions only, and no indication of wind frequency.

Ancient meteorological instruments are also found on postal items, which is not unusual since weather observations have been made for centuries in some areas of the world. One artifact related to wind measurement is the wind observatory stone foundation seen on South Korea (1987/*Scott* 1458) that dates from the Chosun Dynasty.

## The Windsock

The final type of wind detection device to be discussed is the windsock. A windsock consists of conical-shaped fabric tube with the




**Richard's Wind Speed Recorder**
**Maldives (*Scott* 468)**


**Wind Rose Captures Wind Pattern**
**Hong Kong (*Scott* 428)**

**Windsocks Provide Wind Direction**
**South Korea (*Scott* 321)**

tip cut off and the large end attached to a ring that can pivot. Windsocks catch the wind so that the orientation of the sock gives the wind direction and the shape of the tube provides an estimate of the wind speed, or the extent to which the windsock blows horizontally as opposed to hanging vertically without wind. Windsocks are typically used at airports and are usually large enough to be easily seen from small aircraft as they approach and circle the airport before landing. The windsock helps the pilot fly into the wind both upon takeoff and landing, to maximize the lift on the aircraft, or to minimize cross winds if alternate landing strips are available.

Windsocks are seen on the following stamps: Anguilla (1968/*Scott* 24, 1969/*Scott* 60); Denmark (1991/*Scott* 949); Finland (1988/*Scott* 773); Grenada (1984/*Scott* 1243); Israel (1959/*Scott* 161); Japan 610); South Korea (1961/*Scott* 321, 321a); Romania (1960/*Scott* C85); and Upper Volta (1979/*Scott* 522). The Japanese stamp shows a Koinobori paper carp decorative windsock.

The emphasis has been on stamps, souvenir sheets, and postal stationery in this article. However, anemometers are also seen on many other types of philatelic items such as cancels and cachets on covers, as well as postal meters. A checklist of all the items mentioned, as well as many additional postal items that are not discussed in this article can be found on the author's Website *<http://www.cira.colostate.edu/ ramm/hillger/weather.htm>*

Images of most of the postal items are also available on the website. If readers know of other postal items showing anemometers or windsocks, the authors would appreciate learning about them.•


**Hand-held Anemometers Measure Wind Speed**
**Indonesia (*Scott* 840)**

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